GHRSST-PP Diagnostic Data Set (DDS)

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1 Introduction

The GHRSST Diagnostic Data Set (DDS) will comprise of in-situ and satellite data collected at globally distributed, and where possible, instrumented sites that characterise the range of global ocean and atmospheric conditions. At each site, satellite data considered pertinent to the project effort (visible, infrared, passive and active microwave) will be automatically archived, preferably at source, for mostly small ($\sim 2^\circ \times 2^\circ$) areas. Together with in-situ observations collected at many DDS sites, the DDS will provide a data set suitable for (a) the validation and inter-comparison of satellite SSTs, and (b) to help develop and test data-fusion approaches to the development of the next generation of high quality SST. To encourage it's use, the DDS is intended to be an open system, allowing unrestricted public access to all of the data.

This report describes the second (v2.0) data model and file structure proposed for the GHRSST-PP DDS system. It serves as a reference document for the DDS system and will evolve as more experience is gained implementing and using the DDS system. In this respect, data users and providers should contact the authors if any datasets really cannot be fitted into the initial DDS model and file structure: the model and format can be expanded to include features that were not originally considered when drafting this first version as required.

2 Locations

Following suggestions of the GHRSST-PP Science Team at the May 2002 GHRSST-PP meeting in Tokyo, and after circulation of a first version of the

DDS location map, the version 2.0 DDS locations were chosen according to the following general criteria.

- A manageable limit for the number of DDS locations was set to between 100 to 200, so as not to over-burden the data providers.
- The DDS should include high quality climate monitoring moored buoy locations. Note that drifting buoy measurements could also be included where the buoy drifts through one of the fixed DDS locations although it is not clear how this would be achieved. Suggestions on how else to include drifters are welcome.
- It should include locations with long-term in-situ observations.
- DDS sites should collectively provide an unbiased sample of all the worlds oceans to act as inter-satellite calibration windows over an unbiased sample of geophysical conditions.
- The DDS should include a number of well distributed coastal land areas to be used as geolocation quality controls.

Many specific comments raised at the meeting were also taken into account. Appendix A provides the complete list of coordinates, which are also shown in Figure 1.

3 DDS Data Distribution

The distribution of DDS data from Data Provider to Data User will be primarily via the internet, using scientific data servers such as the Distributed Oceanographic Data Server (DODS). Additionally, at least one searchable metadata database along the lines of the NASA Global Change Master Directory (GCMD, gcmd.gsfc.nasa.gov) will be required to help users find the data they need.

Each DDS data set will be addressed by a single URL. This URL points to a directory containing a metadata file which provides the information necessary for the user to download and use the data. The metadata is contained in a single ASCII text file which is made up of two types of record:

Data Set Record This contains most of the information necessary to acquire and use the data in the data set.

Figure 1: DDS v2.2 locations are marked as rectangular boxes, moored buoys and SIMBIOS sites are marked with crosses, and the seasonal limits of the Antarctic ice edge are shown by dashed lines.

File Record This contains the information that distinguishes each file in the data set, including where to find the file. It should not include any information that could be put into the Data Set Record instead.

There is only ever one Data Set Record per data set, but there are as many File Records as there are separate files in the data set. If all the data in the data set is inside just one file, then its location can be described in the Data Set Record and there is no need for a separate File Record.

For example, the DDS URL http://www.sstdata.org/sst/atsr/ might point to a disk directory locally called /raid/pub/sst/atsr/. In this directory there is an ASCII text metadata file called "METADATA". The METADATA file contains a Data Set Record which provides the general characteristics of the dataset, plus one File Record for each data file. Each File Record provides a URL to access an ATSR SST data file, and also provides the more detailed metadata relevant to that file, such as precise image date and/or location.

For interoperability, a GHRSST metadata standard has been defined which follows very closely the Directory Interchange Format (DIF) developed for the GCMD. Since GCMD is a high-level database that does not attempt to index every single data file, a few extensions to the DIF format have been added to accommodate the requirements of GHRSST. However, if one ignores these extensions, the GHRSST Data Set Record is essentially a valid GCMD DIF record.

Example (1) A time series of global monthly SST maps, all projected on to the same grid could be stored as a 3-D array in a single HDF file. A coordinate variable provides the space and time axes. In this case, a single Data Set Record is all that is necessary to fully describe the data set.

The output from oceanographic and meteorological models will often fit this case; the METADATA file containing just one single Data Set Record.

Example (2) All available AVHRR GAC calibrated image subsets, in the original satellite projection, and covering a 2 degree square window in the North Atlantic, over a period from Jan-Dec 1992. Since the satellite projection rasters will not be of the same dimensions, it is easier to keep the data in separate files, one for each original 5-band AVHRR image. In this case, a Data Set Record provides the common parameters, such as, satellite and sensor name, and a separate File Record records the date and time of each individual image.

Field name	*Type*	*Attributes*	*Comment*
DATA SET RECORD			
Entry_ID	char[31]	required, unique	Allocated by GHRSST Project Office
Entry_Title	char[160]	required	
Parameters	group	required	
Data_Center	group	required	Includes a DIF Personnel sub-field
Summary	char[]	required	Multiple lines of 80 chars.
Metadata_Version	char[31]	required	New field
Data_Set_URL	char[160]	required	New field
Projection	char[160]	recommended	New filed
Location	char[31]	recommended	Extended DIF field
FILE RECORD			
Data_File_URL	char[160]	required	New field
Temporal_Coverage	group	recommended	Extended DIF field
Spatial_Coverage	group	recommended	

Table 1: GHRSST DIF minimum set of metadata for DDS data sets.

Example (3) A set of time-series' of moored-buoy in-situ oceanographic and meteorological measurements. Since each buoy is moored in a different but fixed location, it might be most friendly to the user to put each table of measurements for each buoy into a separate file. The File Record would list the buoy's coordinates, and anything specific to each buoy, such as manufacturer, and vandalism events, and a Data Set Record would list the overall characteristics of the data set.

4 GHRSST Metadata Standard

The GHRSST DDS metadata standard is based on the GCMD DIF standard which is fully documented at http://gcmd.gsfc.nasa.gov. In order to understand the GHRSST DDS metadata, you should first read the GCMD DIF standard. In this document we list just the recommended and minimum required metadata and the GHRSST extensions to DIF.

The minimum recommended set of metadata describing a GHRSST DDS data set is shown in Table 1. Any of the GCMD DIF fields not mentioned here may be included at the data providers discretion.

The GHRSST DIF extensions are defined below.

4.1 GHRSST DIF Extensions

Metadata_Version Since we're unlikely to have got the GHRSST DDS metadata standard right first time, we expect it to evolve. Hence the metatdata needs to keep track of which version it is.

Data_Set_URL This points to the directory containing the METADATA file.

Data_File_URL This is a standard URL providing access to a DDS data file. It can be a URL that is relative to the main Data_Set_URL. If there is only one data file in the data set, then this field can be written in the Data Set Record instead, and no File Records need to be present.

Projection A free-text description of the data set's geographic projection.

Location This is a valid GCMD DIF field, but we extend the possible entries to include all of the $\sim$ 150 DDS site names listed in the appendix.

Temporal_Coverage Another valid GCMD DIF field, but we extend it to include not only the start and end dates, but also the UTC start and end times of the data:

```
Group: Temporal_Coverage
   Start_Date: [yyyy-mm-dd]
   Start_Time: [hh:mm:ss]
   Stop_Date: [yyyy-mm-dd]
   Stop_Time: [hh:mm:ss]
End_Group
```

Notes

- All the File Records in a data set should contain the same set of fields.
- Many of the metadata fields can appear more than once, e.g. Parameters should be repeated for each physical quantity represented (SST, wind-speed, etc.).
- The Entry_ID should be allocated by the GHRSST Project Office ensure uniqueness. If all the GHRSST DDS datasets are entered into the GCMD, then the Entry_ID should be that allocated by GCMD, so the GHRSST metadata records can be entered directly into GCMD.

For efficiency, the Entry_ID's could be allocated to each Data Centre in blocks, rather than one at a time.

- Through use of the Related_URL field, a Data Set Record can refer to ancillary metadata or data that does not fit the above scheme.

5 GHRSST DIF Example: ATSR SST

Here is the GHRSST DIF METADATA file for an ATSR SST DDS data set for 1999:

```
Group: Data_Set_Record
   Entry_ID: GHRSST_DDS_ATSR_ASST_1999
   Entry_Title: ATSR Averaged Sea-Surface Temperature over GHRSST
                Diagnostic Data Set (DDS) locations for the year 1999
   Group: Parameters
      Category: EARTH SCIENCE
      Topic:    Oceans
      Term:     Ocean Temperature
      Variable: Sea Surface Temperature
   End_Group
   Group: Data_Center
      Data_Center_Name:  JRC/SAI > Institute for Environment and Sustainability
                         at Joint Research Center (JRC), Ispra (VA), Italy
      Data_Center_URL: http://www.imw.ies.jrc.it/
      Group: Personnel
         Role: Data Center Contact
         First_Name: Craig
         Last_Name: Donlon
         Email: craig.donlon@jrc.it
         Group: Address
            Inland and Marine Waters Unit
            Institute for Environment and Sustainability
            TP272, Joint Research Centre
            21020 Ispra (VA)
            Italia
         End_Group
      End_Group
   End_Group
   Group: Summary
      This GHRSST DDS data set contains subsets of the v3.21 RAL ATSR-2 ASST
      product for 1999, extracted over the DDS locations.
      ...etc...
   End_Group
```

```
   Metadata_Version: GHRSST DIF v1.0
   Data_Set_URL: http://ghrsst.imw.ies.jrc.it/dds/atsr/sst/
   Projection: Latitude-longitude (geodetic)
   Group: Temporal_Coverage
      Start_Date: 1999-01-01
      Stop_Date: 1999-12-31
   End_Group
   Group: Spatial_Coverage
      Southernmost_Latitude: 90S
      Northernmost_Latitude: 90N
      Westernmost_Longitude: 180W
      Easternmost_Longitude: 180E
   End_Group
End_Group

Group: File_Record
   Data_File_URL: 1999/dds_ghr001_atsr2_sst_19990101_asc.hdf
   Location: ghr001
   Group: Spatial_Coverage
      Southernmost_Latitude: 71N
      Northernmost_Latitude: 79N
      Westernmost_Longitude:  9W
      Easternmost_Longitude:  7W
   End_Group
   Group: Temporal_Coverage
      Start_Date: 1999-01-01
      Start_Time: 16:21:37
      Stop_Date: 1999-01-01
      Stop_Time: 16:21:59
   End_Group
End_Group

Group: File_Record
   Data_File_URL: 1999/dds_ghr002_atsr2_sst_19990101_asc.hdf
   Location: ghr002
   Group: Spatial_Coverage
      Southernmost_Latitude: 51N
      Northernmost_Latitude: 49N
      Westernmost_Longitude: 16W
      Easternmost_Longitude: 14W
   End_Group
   Group: Temporal_Coverage
      Start_Date: 1999-01-01
      Start_Time: 15:01:20
      Stop_Date: 1999-01-01
```

Field Name	*Examples*	*Comment*
DDS marker	dds	All DDS file names should start with this prefix
DDS name	ghr002, tao023	Name of the DDS location
Data source	atsr2, avhrrgac, pirata27	Sensor name, rather than data provider
Data type	sst, windspeed, image, multi	multi ⇒ Multiple data types in the same file
Start date	19991231 (yyyymmdd)	UTC
Start time	235959 (hhmmss)	UTC
Period	1day, 30day, 1mth, 12mth, 1yr	Avoid unit of "week", use 7day instead
Format	hdf, cdf, txt	Preferred format is HDF version 4

Table 2: Parts of the DDS file name.

```
    Stop_Time: 15:01:33
  End_Group
End_Group

...etc...
```

6 A Proposal for Standard File Names

This section contains a proposal for a file naming convention. Since the data file names are specified by the metadata, this naming convention is not obligatory.

The file name's purpose is to give a unique and human-recognisable designation to each data granule. Because of the wide range of data types that can form a DDS dataset, it is difficult to devise an easy to use file name convention that also ensures a unique designation for each data type. We therefore propose only *guidelines*, which are likely to be expanded as new data types are introduced into the DDS archive.

Table 2 lists the meaning of each part of the recommended DDS file name. The file name should contain either a start time or a period field, but probably not both, nor neither. Irrelevant fields should be dropped. The field separator is an underscore, except for the last field, format, which is preceded by a full stop. These filenames are then compatible with both

UNIX (MacOS?) and Microsoft operating systems.

Examples:

1. `dds_pir032_atsr2_sst_19990101_1day.hdf`

2. `dds_pir032_pirata_multi_19990101_1mth.hdf`

3. `dds_pir032_avhrrgac_image_19990101_125959.hdf`

New data types should attempt to follow the spirit of these conventions, as far as is reasonable.

7 Use Cases

7.1 How does a user use the DDS?

To see how the DDS would in practise be useful to a user, here is a "use-case" scenario: User A.N. Other wants to check under what meteorological conditions the microwave radiometer SSTs differ from the analysed AVHRR SSTs in the Indian Ocean.

1. User searches the GHRSST-PP main web metadata database for all DDS SST datasets from AVHRR and AMSR, plus NCEP met analyses over a lat-lon rectangle containing the Indian Ocean for year 2000.

2. The GHRSST-PP web database will return a page listing the set of matching metadata records, with hyperlinks pointing directly to each data file. The various data files would probably be produced by different institutes, and hence be located at different internet sites.

3. The user could then:

   (a) Download individual DDS granules using the hyperlinks provided, and work on the files locally.

   (b) Download *all* the matching data files in one go (How?).

   (c) Interrogate the data directly via the DODs interface.

7.2 How does the data provider set up and maintain the DDS?

1. Provider extracts DDS subsets from their datasets over the DDS window locations (Appendix A), and places the files on an open web server, preferably enabled with DODs software.

2. Provider obtains a GHRSST-PP Entry_ID string from the GHRSST-PP project office and writes a METADATA file containing a Data Set Record and n File Records, and places this in the directory (or common parent directory) from where the data files will be served.

3. Provider notifies the user community of the existence of the new dataset by emailing the URL of the METADATA file the the GHRSST-PP project office. The project office then ensures the GHRSST-PP web metadata database is scheduled to mirror and publish the METADATA file.

4. As new satellite data is acquired, the provider extracts the DDS subsets and appends new File Records to the METADATA file. The GHRSST-PP project office could either be manually notified of the updates, or the GHRSST-PP metadata database could be set up to automatically check for updates every few days.

Note that original versions of the metadata describing each data set are stored with the data itself. It is the responsibility of any remote database storing a collection of DDS metadata to keep itself up to date with the original metadata stored with the data, for instance by frequently interrogating the Data Center to find out about any changes.

8 Appendix A

Table of DDS locations from dds_coords_v2.2.dat

```
##################################################################################
#
# GODAE/GHRSST-PP Diagnostic Data Set (DDS) coordinates
#
# VERSION 2
#
# Maintained by: Simon Pinnock & Craig Donlon
#
#################################################################################
#
# Revision History
#
# v2.0, 1-Jul-2002, SP
# Created
#
```

```
# v2.1, 1-Aug-2002, SP
# Updated longitude of Qinghai Hu Lake DDS.
#
# v2.2, 26-Aug-2002, SP
# Corrected mistake where both CAN-46147 and CAN-44141 were labelled as "can001"
#
##################################################################################
#
#
# long name       , short name, lat , lon    , y-size, x-size, comment
#
GHRSST            , ghr001 ,  35    ,  -15   ,  2.0  ,  2.0  , Madeira
GHRSST            , ghr002 ,  50    ,  -30   ,  2.0  ,  2.0  , N Ntlantic
GHRSST            , ghr003 ,  30    ,  -30   ,  2.0  ,  2.0  , Central N Sub-tropical Atlantic
GHRSST            , ghr004 , -20    ,  -30   ,  2.0  ,  2.0  , Central S Sub-tropical Atlantic
GHRSST            , ghr005 , -62.5  ,  -30   , 25.0  ,  5.0  , Weddel Sea (ice edge)
GHRSST            , ghr006 ,  50    ,  -45   ,  2.0  ,  2.0  , W N Atlantic
GHRSST            , ghr007 ,  30    ,  -50   ,  2.0  ,  2.0  , W Atlantic
GHRSST            , ghr008 , -38    ,  -45   ,  2.0  ,  2.0  , Argentina coast
GHRSST            , ghr009 ,  72.5  ,  -65   ,  5.0  ,  5.0  , Baffin Bay
GHRSST            , ghr010 , -62.5  ,  -70   , 15.0  ,  5.0  , Drake passage (ice edge)
GHRSST            , ghr011 , -30    ,  -74   ,  2.0  ,  2.0  , Chile
GHRSST            , ghr012 , -45    ,  -90   ,  2.0  ,  2.0  , Pacific-Antarctic basin
GHRSST            , ghr013 , -25    , -105   ,  2.0  ,  2.0  , Easter Island
GHRSST            , ghr014 , -45    , -110   ,  2.0  ,  2.0  , Pacific Antarctic Ridge
GHRSST            , ghr015 , -67.5  , -110   , 15.0  ,  5.0  , Amudsen Sea (ice edge)
GHRSST            , ghr016 , -37    , -130   ,  2.0  ,  2.0  , Pitcairn Isaland S Pacific
GHRSST            , ghr017 ,  30    , -150   ,  2.0  ,  2.0  , Central N Pacific
GHRSST            , ghr018 , -37    , -150   ,  2.0  ,  2.0  , S Central Pacific
GHRSST            , ghr019 , -65    , -150   , 20.0  ,  5.0  , W Ross Sea (ice edge)
GHRSST            , ghr020 ,  70    , -170   ,  5.0  ,  5.0  , Chukchi Sea
GHRSST            , ghr021 ,  40    , -170   ,  2.0  ,  2.0  , Alutian Islands
GHRSST            , ghr022 , -45    , -170   ,  2.0  ,  2.0  , Kermadec trench, S Pacific
GHRSST            , ghr023 ,  50    ,  170   ,  2.0  ,  2.0  , W Alutian Islands
GHRSST            , ghr024 ,  30    ,  170   ,  2.0  ,  2.0  , NW Pacific
GHRSST            , ghr025 , -30    ,  170   ,  2.0  ,  2.0  , Norfolk Is. S Pacific
GHRSST            , ghr026 , -65    ,  170   , 20.0  ,  5.0  , E Ross Sea (ice edge)
GHRSST            , ghr027 ,  55    ,  150   ,  2.0  ,  2.0  , Sea of Okhotsk
GHRSST            , ghr028 , -15    ,  150   ,  2.0  ,  2.0  , Coral Sea
GHRSST            , ghr029 , -45    ,  150   ,  2.0  ,  2.0  , S Tasman Ridge
GHRSST            , ghr030 , -61    ,  130   , 12.0  ,  5.0  , S Ocean (ice edge)
GHRSST            , ghr031 ,   7    ,  110   ,  2.0  ,  2.0  , S China Sea
GHRSST            , ghr032 , -15    ,  110   ,  2.0  ,  2.0  , Java Trench
GHRSST            , ghr033 , -45    ,  110   ,  2.0  ,  2.0  , Eastern S Ocean
GHRSST            , ghr034 ,  15    ,   90   ,  2.0  ,  2.0  , Bay of Bengal
GHRSST            , ghr035 , -30    ,   90   ,  2.0  ,  2.0  , Central S. Ocean
GHRSST            , ghr036 , -45    ,   90   ,  2.0  ,  2.0  , Central S. Ocean
GHRSST            , ghr037 , -61    ,   90   , 12.0  ,  5.0  , S Ocean (ice edge)
GHRSST            , ghr038 ,  20    ,   65   ,  2.0  ,  2.0  , Arabian Sea
```

```
GHRSST           , ghr039 ,  10    ,   55   ,  2.0  ,  2.0  , Somali Jet
GHRSST           , ghr040 , -10    ,   70   ,  2.0  ,  2.0  , Indian Ocean
GHRSST           , ghr041 , -30    ,   70   ,  2.0  ,  2.0  , S Indian Ocean
GHRSST           , ghr042 , -45    ,   70   ,  2.0  ,  2.0  , Kerguelen Is. S Ocean
GHRSST           , ghr043 ,  -5    ,   50   ,  2.0  ,  2.0  , Somali Basin
GHRSST           , ghr044 , -30    ,   50   ,  2.0  ,  2.0  , Mauritius Basin
GHRSST           , ghr045 , -45    ,   50   ,  2.0  ,  2.0  , S Indian Ocean
GHRSST           , ghr046 , -61    ,   50   , 12.0  ,  5.0  , S Indian Ocean (ice edge)
GHRSST           , ghr047 , -45    ,   30   ,  2.0  ,  2.0  , Agulhas Basin
GHRSST           , ghr048 ,  36    ,   19   ,  2.0  ,  2.0  , Meditteranean
GHRSST           , ghr049 , -30    ,    0   ,  2.0  ,  2.0  , SE Atlantic
GHRSST           , ghr050 , -60    ,   10   , 20.0  ,  5.0  , SE Atlantic (ice edge)
GHRSST           , ghr051 ,  60.0  , -55.0  ,  5.0  ,  5.0  , Davis Strait
GHRSST           , ghr052 ,  60.0  , -30.0  ,  2.0  ,  2.0  , Denmark Strait
GHRSST           , ghr053 ,  43.0  ,  31.5  ,  2.0  ,  2.0  , Black Sea
GHRSST           , ghr054 ,  42.5  ,  50.0  ,  2.0  ,  2.0  , Caspian Sea
GHRSST           , ghr055 ,  39.2  ,-120.0  ,  1.0  ,  1.0  , Lake Tahoe, USA
GHRSST           , ghr056 ,  36.8  , 100.2  ,  1.0  ,  1.5  , Qinghai Hu Lake, China
GHRSST           , ghr057 ,  17.5  ,  40.0  ,  2.0  ,  2.0  , Red Sea
GHRSST           , ghr058 , -15.0  , -80.0  ,  2.0  ,  2.0  , Peru current
GHRSST           , ghr059 , -20.0  , -85.0  ,  2.0  ,  2.0  , IMET/EPIC mooring under stratus cloud
GHRSST           , ghr060 ,  40.0  ,   6.0  ,  2.0  ,  2.0  , Western Meiterranean
GHRSST           , ghr061 , -20.0  , 150.0  ,  2.0  ,  2.0  , Great Barrier Reef
GHRSST           , ghr062 ,  59.0  , -86.0  ,  2.0  ,  2.0  , Hudson Bay
GHRSST           , ghr063 ,  75.0  ,   0.0  , 12.0  ,  5.0  , Greenland Sea and ice edge
GHRSST           , ghr064 ,  25.0  , -81.0  ,  2.0  ,  2.0  , Florida Keys (C-MAN sites)
GHRSST           , ghr065 , -40.0  , -20.0  ,  2.0  ,  2.0  , S Atlantic
GHRSST           , ghr066 ,  75.0  ,  40.0  ,  5.0  ,  5.0  , Barents Sea
GHRSST           , ghr067 ,  74.0  , 130.0  ,  5.0  ,  5.0  , Laptev Sea
GHRSST           , ghr068 , -20.0  ,-140.0  ,  2.0  ,  2.0  , South Pacific
#
# DDSs located over moored buoys
#
NDBC-46035       , ndb051 ,  57.08 ,-177.71 ,  2.0  ,  2.0  , Bering Sea
TAO              , tao038 ,   8.0  ,-170.0  ,  2.0  ,  2.0  , (Aug 1992)
TAO              , tao044 ,  -8.0  ,-170.0  ,  2.0  ,  2.0  , (Aug 1992)
TAO              , tao041 ,   0.0  ,-170.0  ,  2.0  ,  2.0  , (May 1998)
NDBC-46066       , ndb063 ,  52.65 ,-155.00 ,  2.0  ,  2.0  , Kodiak
TAO              , tao031 ,   8.0  ,-155.0  ,  2.0  ,  2.0  , (Aug 1992)
TAO              , tao037 ,  -8.0  ,-155.0  ,  2.0  ,  2.0  , (Mar 1992)
NDBC-46006       , ndb039 , 40.84  ,-137.49 ,  2.0  ,  2.0  , SW. Astoria
TAO              , tao018 ,   8.0  ,-125.0  ,  2.0  ,  2.0  , (Oct 1992)
TAO              , tao021 ,   0.0  ,-125.0  ,  2.0  ,  2.0  , (Oct 1983)
TAO              , tao024 ,  -8.0  ,-125.0  ,  2.0  ,  2.0  , (Sep 1992)
TAO              , tao025 ,   9.0  ,-140.0  ,  2.0  ,  2.0  , (May 1988)
TAO              , tao028 ,   0.0  ,-140.0  ,  2.0  ,  2.0  , (Apr 1983)
TAO              , tao030 ,  -5.0  ,-140.0  ,  2.0  ,  2.0  , (Oct 1990)
TAO              , tao011 ,   8.0  ,-110.0  ,  2.0  ,  2.0  , (Oct 1991)
TAO              , tao014 ,   0.0  ,-110.0  ,  2.0  ,  2.0  , (Jan 1979)
```

```
TAO               , tao017 ,  -8.0  ,-110.0  ,  2.0  ,  2.0  , (Nov 1985)
TAO               , tao001 ,  12.0  , -95.0  ,  2.0  ,  2.0  , (Dec 1999)
TAO               , tao007 ,   0.0  , -95.0  ,  2.0  ,  2.0  , (Jul 1981, inactive '83-'92)
TAO               , tao010 ,  -8.0  , -95.0  ,  2.0  ,  2.0  , (Aug 1994)
CAN-46147         , can001 ,  51.83 ,-131.22 ,  2.0  ,  2.0  , Vancouver
MF-41100          , mfr001 ,  15.9  , -57.9  ,  2.0  ,  2.0  , Antilles (Meteo France)
CAN-44141         , can002 ,  42.10 , -56.22 ,  2.0  ,  2.0  , Gulf Stream
EGOS-62081        , ego003 ,  51.0  , -13.3  ,  2.0  ,  2.0  , Celtic Sea
PIRATA-Reggae     , pir007 ,  15.0  , -38.0  ,  2.0  ,  2.0  , (Jan 1998)
PIRATA-Forro      , pir008 ,  12.0  , -38.0  ,  2.0  ,  2.0  , (Feb 1999)
PIRATA-Lambada    , pir009 ,   8.0  , -38.0  ,  2.0  ,  2.0  , (Jan 1998)
PIRATA-Frevo      , pir010 ,   4.0  , -38.0  ,  2.0  ,  2.0  , (Feb 1999)
PIRATA-Samba      , pir006 ,   0.0  , -35.0  ,  2.0  ,  2.0  , (Jan 1998)
PIRATA-Jazz       , pir005 ,   0.0  , -23.0  ,  2.0  ,  2.0  , (Mar 1999)
PIRATA-Soul       , pir001 ,   0.0  ,   0.0  ,  2.0  ,  2.0  , (Feb 1998)
PIRATA-Java       , pir002 ,   0.0  , -10.0  ,  2.0  ,  2.0  , (Sep 1997)
PIRATA-Valse      , pir003 ,  -6.0  , -10.0  ,  2.0  ,  2.0  , (Mar 2000)
PIRATA-Gavotte    , pir004 , -10.0  , -10.0  ,  2.0  ,  2.0  , (Sep 1997)
UKMO-63117        , ukm004 ,  58.0  ,   1.10 ,  2.0  ,  2.0  , North Sea
TAO/TRITON        , tao073 ,  -5.0  ,  95.0  ,  2.0  ,  2.0  , (26 Oct 2001)
NDBC-45001        , ndb027 , 48.06  , -87.78 ,  2.0  ,  2.0  , Mid Lake Superior, USA
TAO/TRITON        , tao069 ,   8.0  , 137.0  ,  2.0  ,  2.0  , (28 Sep 2001)
TAO/TRITON        , tao071 ,   0.0  , 138.0  ,  2.0  ,  2.0  , (03 Oct 2001)
TAO/TRITON        , tao065 ,   5.0  , 147.0  ,  2.0  ,  2.0  , (Feb 1990; Triton from 1999)
TAO/TRITON        , tao067 ,   0.0  , 147.0  ,  2.0  ,  2.0  , (Apr 1994; Triton from 1999)
TAO/TRITON        , tao059 ,   8.0  , 156.0  ,  2.0  ,  2.0  , (Dec 1994; Triton from 1999)
TAO/TRITON        , tao062 ,   0.0  , 156.0  ,  2.0  ,  2.0  , (Jul 1995; Triton from 1999)
TAO/TRITON        , tao064 ,  -5.0  , 156.0  ,  2.0  ,  2.0  , (Aug 1991; Triton from 1999)
TAO               , tao055 ,   0.0  , 165.0  ,  2.0  ,  2.0  , (Jan 1986)
TAO               , tao052 ,   8.0  , 165.0  ,  2.0  ,  2.0  , (Jul 1989)
TAO               , tao058 ,  -8.0  , 165.0  ,  2.0  ,  2.0  , (Aug 1991)
TAO               , tao045 ,   8.0  , 180.0  ,  2.0  ,  2.0  , (Nov 1993)
TAO               , tao048 ,   0.0  , 180.0  ,  2.0  ,  2.0  , (Mar 1993)
TAO               , tao051 ,  -8.0  , 180.0  ,  2.0  ,  2.0  , (Nov 1993)
NDBC-42002        , ndb008 , 25.17  , -94.42 ,  2.0  ,  2.0  , Western Gulf
#
# SIMBIOS ``Diagnostic Data Set Sites'' locations from sites.xls table from
# http://simbios.gsfc.nasa.gov/Info/STM2001/Sites.html
# Note: XLS table site coordinates differ significantly from those listed on
# the above web page (which is correct???)
# The Ishigaki site is listed twice (2nd time as ``YBOM replacement'')  in the XLS file.
#
SIMBIOS-MOBY                , sim001 ,  20.8  ,-157.20 , 2.0 , 2.0 , Hawaii
SIMBIOS-BATS/BTM            , sim002 ,  32.0  , -64.50 , 2.0 , 2.0 , Bermuda
SIMBIOS-CALCOFI             , sim003 ,  29.85 ,-123.59 , 2.0 , 2.0 , California
SIMBIOS-EqPAC               , sim004 ,   0.0  ,-155.00 , 2.0 , 2.0 , Eastern Equ Pacific
SIMBIOS-HOT                 , sim005 ,  22.75 ,-158.00 , 2.0 , 2.0 , Hawaii
SIMBIOS-Ishigaki            , sim006 ,  24.39 , 123.27 , 2.0 , 2.0 , East China Sea
SIMBIOS-Ligurian_Sea        , sim007 ,  43.37 ,   7.90 , 2.0 , 2.0 , Mediterranean
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SIMBIOS-Lower_Chesapeake_Bay , sim008 ,  37.40 , -76.13 , 2.0 , 2.0 , Virginia
SIMBIOS-Monterey_Bay         , sim009 ,  36.75 ,-122.42 , 2.0 , 2.0 , Monterey
SIMBIOS-Plymbody             , sim010 ,  50.2  ,  -4.10 , 2.0 , 2.0 , English Channel
SIMBIOS-Venice_Tower         , sim011 ,  45.31 ,  12.60 , 2.0 , 2.0 , Northern Adriatic
SIMBIOS-Station_H            , sim012 ,  41.5  , 145.78 , 2.0 , 2.0 , Japan East Coast
SIMBIOS-Cariaco_Basin        , sim013 ,  10.5  , -64.66 , 2.0 , 2.0 , Venezuela
SIMBIOS-Kashidoo             , sim014 ,   4.95 ,  73.45 , 2.0 , 2.0 , Maldives Islands
SIMBIOS-Korean               , sim015 ,  32.0  , 125.00 , 2.0 , 2.0 , East China Sea
SIMBIOS-LEO_15               , sim016 ,  39.3  , -74.25 , 2.0 , 2.0 , New Jersey
SIMBIOS-Plumes_and_Blumes    , sim017 ,  34.25 ,-119.92 , 2.0 , 2.0 , off Santa Barbara CA
SIMBIOS-Scotian_Prince_Route , sim018 ,  43.00 , -69.00 , 2.0 , 2.0 , Gulf of Maine
SIMBIOS-NOAA-GOM             , sim019 ,  29.50 , -87.50 , 2.0 , 2.0 , Northern Gulf of Mexico
SIMBIOS-NOAA-NC              , sim020 ,  35.00 , -76.50 , 2.0 , 2.0 , off North Carolina
SIMBIOS-Rottnest_Island      , sim021 , -31.80 , 115.30 , 2.0 , 2.0 , off Western Australia
#
# Other proposed SIMBIOS sites:
#
SIMBIOS-Arm_1                , sim022 ,   0.00 , 168.00 , 2.0 , 2.0 , Nauru Island
SIMBIOS-Arm_2                , sim023 ,  25.00 , 148.00 , 2.0 , 2.0 , Manus Island
SIMBIOS-NW_Afr_Upwell        , sim025 ,  21.00 , -17.50 , 2.0 , 2.0 , Morocco
SIMBIOS-Alberon_Gyre         , sim026 ,  33.00 ,  32.50 , 2.0 , 2.0 , Eastern Mediterranean
SIMBIOS-Helgoland            , sim027 ,  54.00 ,   9.00 , 2.0 , 2.0 , North Sea
SIMBIOS-Nordic               , sim028 ,  55.00 ,  19.30 , 2.0 , 2.0 , Baltic Sea
SIMBIOS-Luderitz_Upwell      , sim029 , -26.00 ,  14.50 , 2.0 , 2.0 , Namibia
SIMBIOS-Philippine_Sea       , sim030 ,  17.00 , 133.00 , 2.0 , 2.0 , Southeast Asia
SIMBIOS-Cook_Islands         , sim031 , -20.00 ,-163.00 , 2.0 , 2.0 , Australia
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